REMARKS FOR ADMINISTRATOR BOLDEN

INTERNATIONAL ASTRONAUTICAL CONGRESS

SPACE GENERATION CONGRESS

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Thank you to all the members of the Space Generation Advisory Council for the invitation to speak with you tonight. Congratulations on this 13th annual Space Generation Congress and the 15th anniversary of the Space Generation Advisory Council.

One of my great pleasures as head of NASA is the opportunity to talk to young people in the United States and around the world who are interested in science, aeronautics and space. I had the honor of speaking to this group in Beijing last year, in Cape Town in 2011 and in Prague in 2010, and I always come away impressed with the talent, brains and commitment of the young people who attend these gatherings.

Looking out at all of you, I have no doubt that the future of space exploration and the future of our planet is in good hands.

Coming to a meeting like the IAC, it's clear that a new era of space exploration is being shaped by an unprecedented and welcome influx of new international partners from around the world. I understand that the Space Generation Advisory Council now has thousands of members representing 100 countries. As we venture farther into our solar system with the hope of making new discoveries to expand human knowledge and benefit life on Earth, we are going to need the cooperation of the world community – and the engagement of its young people, who are going to lead tomorrow's missions. I'm confident that we'll get to Mars, but it's not going to be my generation that sets foot there. That's truly up to you!

You truly are the space generation, because you live in a world where there hasn't been a point in your lifetime where humanity had not ventured to space. Even your younger brothers and sisters may not know a time when humans have not lived in space – we're coming up on the 14th anniversary of continuous human occupation of the International Space Station.

The young people of today are used to satellites of all types visible with the naked eye at twilight no matter where they live. You and I rely on many of these satellites to feed the devices we use to call our friends, look up information or just entertain ourselves – in short, to connect us all no matter where we live.

People compare the growth of spaceflight to the growth of aviation. Within 50 years of the Wright Brothers' first flight, commercial air travel was widespread to the average person, and commerce depended on it.

We're not quite there yet with spaceflight, but 56 years after NASA was formed, we now have regular cargo delivery to low Earth orbit by two companies. We are about three years away of commercial transport of astronauts to low Earth orbit, and that doesn't even take into account space tourism and the private companies that are going to take folks on suborbital flights, perhaps as early as next year.

NASA also has been contracting with flight providers to enable more opportunities for industry, academia and other government agencies to fly payloads to suborbital space – something that will increase access and allow things to be tested before they go all the way to the unforgiving environment of low Earth orbit and beyond.

Phonesats and Cubesats have demonstrated that low cost, readily available technology can provide some of the benefits that, in the past, required expensive spacecraft and complex missions.

If you watch an old science fiction television show from the 1960s or 70s, you're likely to see a computer that took up an entire room and had tape running on reels. Now you hold many times more computing power than such a machine in the palm of your hand. It's part of the evolution of our field that much of what once was the province of governments has become available to industry and citizens no matter where they live.

Citizen scientists and inventors are helping NASA with their ideas about asteroids, about Mars spacecraft, about innovative computer software. When you look at what's really going on in the field, it's incredible how much things have opened up, and so much richness of innovation and inspiration is flooding into aerospace. People like you are all over the world, looking to create the future, and helping NASA continue to do the big things that no one else can.

Together, we're making the next giant leaps and this is what I want to talk to you about tonight. With all the marvels of technology and innovation that we all take for granted, there is still wonder to behold. There are still marvels to create.

At NASA, we're on a journey to Mars, and I invite you to come along.

All space exploration expands the frontiers of scientific knowledge and improves life for everyone on Earth. I think if we start from that point, we're off to a great start.

It was my pleasure last week to congratulate the Indian Space Research Organisation as its Mars Orbiter Mission (*MOM*) arrived at Mars. Coincidentally, NASA's *MAVEN* spacecraft had also just arrived two days earlier, so we've exponentially increased our potential understanding of the Red Planet in just a single week. Mars is hard! So these milestones need to be recognized.

These science missions are precursors to sending humans there in the 2030s. Our *Curiosity* rover continues to send back incredible science data after demonstrating that life could have been possible on Mars at some point. We're also sending a lander to study the planet's core in 2016 and another *Curiosity*-type rover there in 2020 with participation from France, Spain and Norway.

Any human mission to Mars is going to involve the efforts of many nations. In fact it already does, as we can see from the variety of spacecraft currently studying the Red Planet.

I know your working groups have been discussing the ethics and strategies for human space exploration, and right now that's playing out at NASA in commercial space and our journey to Mars, of which commercial cargo and crew are parts.

While humans have been fascinated with Mars since the beginning of time, there are a number of very tangible reasons why we need to learn more about our closest planetary neighbor. For one thing, Mars' formation and evolution are comparable to Earth's. We know that at one time Mars had conditions suitable for life. What we learn about the Red Planet may tell us more about our own history and future and help us answer a fundamental human question – does life exist beyond Earth?

While robotic explorers have studied Mars for more than 40 years, NASA's path for the human exploration of Mars begins in low-Earth orbit aboard the International Space Station, our springboard to the exploration of deep space. As we speak, astronauts aboard the ISS are helping us learn how to safely execute extended missions deeper into space. President Obama's commitment to extend the ISS until at least 2024 guarantees we'll have this unique orbiting outpost for at least another decade.

This means an expanded market for private space companies, more groundbreaking research and science discovery in micro-gravity and opportunities to live, work and learn in space over longer periods of time.

The Space Launch System rocket that will carry our *Orion* crew vehicle on missions to an asteroid and eventually to Mars reached a major milestone in August when we completed a rigorous review and approved the program's progression from formulation to development, a significant milestone on our return to human exploration beyond low-Earth orbit.

I was pleased to travel on the Navy ship carrying an engineering test article of *Orion* on its water recovery tests a couple of weeks ago. The test simulated how *Orion* will actually return to Earth.

We're making great progress toward *Orion's* first flight test this December, when it will travel farther than a spacecraft built for humans has traveled in 40 years, and it will simulate a reentry from a lunar mission. The spacecraft is at the Kennedy Space Center now undergoing processing.

This will be followed by an uncrewed test flight of the joint Space Launch System/*Orion* in 2017 and the first crewed test flight in 2021.

While NASA is focused on human missions to deep space and to places no one has ever gone before, we are handing over transport to the International Space Station and other low-Earth orbit destinations to those private companies I mentioned earlier.

We now are in the enviable position of having two partners successfully launching cargo missions to the Space Station – SpaceX and Orbital Sciences.

The most recent SpaceX mission launched just two weeks ago and carried supplies and a lot of science, including the *RapidScat* instrument to study ocean winds. Another Orbital mission is just around the corner later this month.

Two weeks ago we also were very excited to announce that the Boeing Company and SpaceX will be the carriers of astronauts to low Earth orbit by 2017. This is an historic milestone and validates our faith and our investment in commercial space.

Commercial space is part of our strategy for a journey to Mars. We're turning access to low Earth orbit over to industry with our oversight and the same strict safety protocols we've always observed. While that's happening, we're working on a mission to redirect an asteroid closer to our moon so astronauts can visit it.

In a lunar orbit, we'll also be testing cutting edge new technologies such as solar electric propulsion in the "proving ground" of deep space, with the ultimate goal of sending humans to Mars.

I've been talking for a while and I still have not mentioned NASA Science, which even now has spacecraft speeding to Pluto and Jupiter. The James Webb Space Telescope continues to make each milestone on its path to a 2018 launch. Not too far away in the big picture.

It's also been an incredible year in Earth Science, with the Global Precipitation Mission (*GPM*), a cooperative mission with the Japan Aerospace Exploration Agency (JAXA), launched in February to provide measurements of rain and snowfall worldwide. The Orbiting Carbon Observatory-2 (*OCO-2*) launched in July to provide accurate global measurements of atmospheric CO2 levels.

And of course there's *RapidScat*, which I mentioned earlier. Upcoming are the Soil Moisture Active Passive (*SMAP*) mission to study the Earth's water cycle and ISS Cloud-Aerosol Transport System (*CATS*) to study how parts of the atmosphere affect climate change.

It's important to recognize – that just scratches the surface of what we, NASA, a leading space agency, but one of many, is doing in human exploration, technology development and science. The writer Zora Neale Hurston said, "No matter how far a person can go, the horizon is still way beyond you."

There's truly much to behold on the horizon, and all of you are at the leading edge of reaching for it. Your commitment to science, technology, engineering and math is the hope of our planet. You're going to help us figure out how to shield astronauts from radiation on the way to Mars.

You're going to help us figure out how to get all that mass to the surface of Mars so humans can set up an outpost there. You're going to take the data from all of our Earth science missions and help us tackle climate change.

Everywhere I go I meet young people like you who understand that STEM-educated workers are needed more than ever to solve global problems that cross all borders.

Space exploration strengthens us all, not only with the new discoveries we make, but with the numerous technologies that are developed with applications directed toward improving life on Earth. Besides that, it brings us together as one world.

Thank you so much for allowing me to join you tonight to participate in this Space Generation Congress. I look forward to hearing your thoughts and ideas about how, together, we can continue to explore the frontiers of space and bring benefits to people around the world.

Thank you.